

## **The algorithm that emulates ants “Here is the zero-impact Web”**

*An Italian start-up, Eco4Cloud, has developed a solution to reduce power consumption of data centers by a factor of one third. It was tested recently in Telecom Italia and it maximizes the capacity of a portion of servers and reduces pollution.*

A small start-up from Calabria (Southern Italy) could save Telecom Italia and free us from guilt as Web users because it can reduce by one third the power consumption of the main Italian telecom company, now equivalent to power used by all the inhabitants of Milan. Only Trenitalia consumes more, but it is a matter of time: after all, the more we use Internet, the larger the energy consumption (and, as a consequence, the carbon emissions in the atmosphere: today, this constitutes 3% of worldwide emissions and is equal to the aviation industry). Just yesterday the vice-president of the European Commission, Noëlie Kroes, said that by 2020 50 billion devices will be connected to the Internet and consuming power, which is a very serious issue; a problem which four Calabrian researchers have tackled by observing the behavior of ants, and devising an algorithm that can lead to a potential saving of 35%. It is a kind of an economical and ecological formula for the Internet.

What do ants have to do with computers? Much more than we can imagine. Since at least 20 years computer scientists are referring to the studies of biologists in order to cope with very complex “mathematically intractable” problems. One of the most famous is the bin packing problem, which is the problem of packing a set of items having variable sizes into the lowest number of bins. Think about it: it resembles the problem faced by the computer farms that make the Internet work. On average, computers are utilized at 30% of their capacity but, since Internet workloads are extremely dynamic, no one has yet found the way to switch off unnecessary servers without deteriorating the quality of the service.

Here is how ants can help. They move and work with no visible strategy, but anthills work perfectly, with no energy waste. Ants use forms of instantaneous communication and probability computation. “Ant colony algorithms” are a well-established research area, but no one has ever thought of applying them to Internet energy issues. At the end of 2010, Eco4Cloud was formed, a company that stemmed from the work of four researchers of ICAR-CNR, the Institute of High Performance Computing and Networks of the Italian National Research Institute: Carlo Mastroianni, Agostino Forestiero, Giuseppe Papuzzo and Raffaele Giordanelli (later joined by Ivana Pellegrino and Domenico Talia). Their intuition was that the workload should not be equally distributed among computers, as 1000 computers utilized at 50% consume much more power than 500 fully utilized computers. Therefore it is better to switch off underworked computers, or hibernate them into a low power state. The conclusion is so logical that it seems strange that no one found it before. Yet, Mastroianni says, “solutions available today are manual, complex and scarcely adaptable, while we propose an automatic, simple and an inherently scalable solution”.

Since then, it has been a progression of achievements for the small start-up of Cosenza: in June 2011 they won the Start Cup Calabria competition; in November, in Turin, they won the special award of Working Capital in the Telecom Italia competition that in the last three years has valorized and backed many novel business ideas. In a short time, the company has closed a deal with dPixel and Principia, two Italian venture capital companies. In last July, Telecom Italia decided to test the solution on the field, in its data center located in Bari. After some customization of the software, the verdict arrives: an energy saving equal to 35%, says the CEO of Telecom Italia, Marco Patuano, according to which “Eco4Cloud is a successful case of bottom-up sustainable innovation, promoted by a small company and adopted by a very big one”.

Today, Telecom Italia has an energy bill of 400 million euros and plans to reduce it by 170 million euro by adopting this solution even without considering the added benefits for the environment in terms of reduced carbon emissions. In these days Eco4Cloud founders are presenting their algorithm in Salt Lake City at the world largest supercomputing conference. Cisco, the company that has built most of Internet infrastructures, is also testing the solution. Among the potential customers are all the Web giants, starting from Google and Facebook, whose huge power consumptions are strictly monitored. The story of this group of researchers of a public center, who put together their skills and knowledge to start a technological exciting project, seems to be at its very beginning.